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Hydrology Branch

Souris River Basin
1982 Spring Runoff

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SOURIS RIVER BASIN

1982 SPRING RUNOFF

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CHAPTER I

INTRODUCTION

A. THE SOURIS RIVER BASIN IN SASKATCHEWAN

The Souris River Basin is basically covered with dark brown soils on a flat to gently rolling plain with some hummocky regions. It's a plain trenched by the valleys of the Souris River and its' tributaries. The Souris River valley is a glacial spillway averaging less than 30 metres in depth; the river channel varies from 1 to 8 metres in depth.

There are four physiographic regions representing the basin in Saskatchewan: the Missouri Coteau, the Souris Plain, the Moose Mountain Upland and the Oxbow till Plain. There are surface elevations of up to 820 metres above mean sea level in the Moose Mountain Uplands but basically the elevation in the basin ranges from 460 metres to 580 metres.

Annual precipitation over the basin averages 400 to 450 mm per year which classifies it as being semiarid. The growing season is approximately 175 days with a period of about 100 days being frost-free.

From the headwater area near Cedoux the Souris River mainstem flows in a northwesterly direction. Near Lewvan, it turns south then southeast through the Yellow Grass Marsh area. Natural drainage

through and immediately below the marsh has been improved by construction of the Yellow Grass Ditch which joins the natural Souris River channel a few kilometres northwest of Weyburn. From the end of the Yellow Grass Ditch the Souris River flows for some 110 km in a southeasterly direction through the City of Weyburn and past the City of Estevan to Roche Percee. It then follows a more easterly course to the community of Glen Ewen and then southerly before crossing the international boundary 23 km south and 3 km east of the Village of Glen Ewen.

Downstream of Weyburn, in the vicinity of Nickle Lake, the depth of the river valley increases. Between Nickle Lake and Dead Lake, a distance of 50 km, there are a number of tributaries, large and small, i.e. Roughbark Creek, which join the river. Downstream of Dead Lake, to the confluence of Long Creek with the Souris River near Estevan, the river has a very low gradient; inundation of the flood plain is a frequent occurrence.

Long Creek, the largest western tributary, joins the Souris River near Estevan. With its headwaters area in the hills west and northwest of Radville, the stream receives most of its flow from the Saskatchewan portion of the drainage area. At the lower end it crosses the International Boundary near Torquay and re-enters Saskatchewan a short distance south of Estevan. Boundary Dam is located on Long Creek just above the confluence. This dam forms the largest and most important storage reservoir in the Saskatchewan portion of the Souris basin, with a storage capacity

of 60 500 cubic decametres (dam^3) at full supply level of 560.83 metres.

East of Estevan, the Souris River is joined at Roche Percee by Short Creek from the south. Moose Mountain Creek, which is the largest northern tributary in Saskatchewan joins the Souris River near Oxbow. A basin map with station locations is shown on Figure 1.

B. SCOPE OF REPORT

This report provides a comprehensive review of events and conditions leading up to and during the 1982 spring runoff in the Souris River Basin. It does not, however, cover runoff in tributaries that drain to the east such as Antler River and Gainsborough and Pipestone Creeks which cross the provincial boundary and join the Souris River in Manitoba.

CHAPTER II

GENERAL HYDROMETEOROLOGICAL AND CHANNEL CONDITIONS PRIOR TO AND DURING SPRING RUNOFF

The summer of 1981 was near normal in the Souris basin with respect to both temperature and precipitation. Normal precipitation and above normal temperatures were experienced during September. October was cooler than normal but precipitation was over 200 per cent of normal. These fall rains provided reasonably good soil moisture content, however, the combination of a light spring runoff the previous spring and no major summer rainstorms, left the depression storage very low. Table 1 provides the precipitation received in the basin June 1, 1981 to May 31, 1982.

During November and December both above normal temperatures and precipitation were experienced in the basin. However, temperatures were cold enough to retain the snow that fell. Rain and thaw actively crusted and held the snowpack firmly in place. January and most of February were bitterly cold with above normal snowfall. These conditions are depicted on Figures 2 and 3.

It was well into March before a warmer spell occurred to start the ripening of the snowpack. By this time, quite a heavy snow cover had accumulated with few wind storms to shift the snow off the fields. Although the gullies and riverbeds were heavily banked with snow along

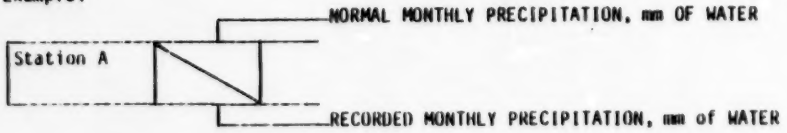
Table 1

SOURIS RIVER BASIN

PRECIPITATION SUMMARY 1981 TO 1982

	1981							1982				
STATION	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY
CARLYLE	79 / 67.2	51 / 39.1	61 / 60.6	38 / 53.2	18 / 42.8	12 / 12.0	16 / 18.5	16 / 24.0	11 / 13.0	15 / 29.0	32 / 12.0	44 / 53.0
CEYLON	79 / 7[illegible].6	51 / 41.4	42 / 35.4	35 / 15.0	16 / 58.6	17 / 35.9	18 / 41.8	17 / 31.8	15 / 29.4	16 / 48.2	32 / 43.4	44 / 91.0
ESTEVAN	79 / 73.0	62 / 57.6	53 / 83.0	30 / 40.9	20 / 22.4	16 / 21.4	18 / 10.3	18 / 40.2	17 / 16.3	18 / 38.1	31 / 12.0	47 / 57.8
KIPLING	93 / 95.2	61 / 33.2	43 / 3[illegible].1	36 / 53.6	24 / 45.4	18 / 11.5	23 / 35.6	21 / 21.6	18 / 8.8	16 / 21.6	24 / 11.5	39 / 46.6
MIDALE	84 / 61.7	58 / 76.0	46 / 63.2	30 / 35.4	14 / 41.6	15 / 21.3	17 / 9.5	15 / 28.5	16 / 16.5	15 / 40.7	26 / 8.6	45 / 59.1
OXBOW	81 / 64.2	58 / 38.0	50 / 75.7	28 / 33.4	18 / 36.1	14 / 11.0		14 / 25.0	20 / 11.0	14 / 19.0	26 / 15.0	37 / 52.0
RADVILLE	76 / 69.7	43 / 65.8	48 / 45.1	33 / 19.3	17 / 40.2	15 / 25.4	22 / 42.7	30 / 58.0	20 / 37.9	20 / 50.7	26 / 38.5	48 / 85.6
WEYBURN	79 / 97.4	53 / 86.9	35 / 36.8	26 / 28.4	14 / 34.2	13 / 23.4	17 / 19.0	14 / 20.3	11 / 16.5	11 / 22.8	29 / 6.6	50 / 74.0
WILLMAR	82 / 93.2	64 / 84.2	56 / 76.4	35 / 59.0	20 / 38.6	14 / 24.6	16 / 33.3	17 / 34.1	14 / 15.4	22 / 37.0	26 / 17.5	38 / 70.7
YELLOW GRASS	76 / 109.8	61 / 59.2	38 / 48.0	31 / 32.8	16 / 47.6	15 / 24.6	17 / 13.6		13 / 20.4	13 / 33.5		43 / 80.9
TOTAL	808 / 809.0	562 / 581.4	472 / 562.3	322 / 371.0	177 / 407.5	149 / 211.1	164 / 224.3	162 / 283.5	155 / 185.2	160 / 340.6	252 / 165.1	435 / 670.7
% OF NORMAL	100	103	119	115	230	142	137	175	119	213	66	154

Example:



the sides there were generally few hard blown drifts clogging or congesting them. The warming temperatures were restricted by the large albedo since the snow cover was heavy and general throughout the basin. Table 2 lists snow depth and water equivalents measured during March 15, 1982 snow surveys.

Temperatures again cooled off and remained cool well into April as shown on Figure 4. When flow began in mid April, temperatures again went to freezing at night and were only moderately above freezing during the day. There was also very little precipitation during April as shown on Figure 5.

During runoff channels were relatively clear so as flows began, they were allowed to pass. Ice was not a large problem because there wasn't much depression storage to make ice in the fall. Road grades were the main obstacle to flow but since the channel opened quickly and there was a moderate rate of melt, these obstructions tended to regulate the flows into longer and more sustained flows, thus cutting down the peaks. Also, the solid blanket of snow tended to melt at a rate conducive to infiltration into the soil.

Table 2

SOURIS RIVER BASIN

MARCH 15 SNOW SURVEYS

YEAR	Alameda		Estevan		Frobisher		Glenarm		Handsworth		Kisbey		Maxim		Neptune		Neptune S		Noonan		Oungre		Trossachs N.F.		Trossachs S.	
	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water
1971	Tr	-	-	-	0	0	8.9	-	0	0	8.9	-	0	0	-	-	0	0	0	0	0	0	0	0	7.9	43.2
1972	26.2	53.3	16.0	40.6	10.9	27.9	35.1	80.0	31.2	68.6	25.7	58.4	0	0	0	0	0	0	4.1	0.3	0	0	10.2	12.7	13.7	27.9
1973	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1974	36.6	91.2	5.6	23.1	16.5	66.0	39.6	109.7	45.2	122.4	27.9	91.7	10.9	40.4	9.1	19.6							14.0	52.3	29.0	112.8
1975	0	0	0	0	0	0	6.4	34.5	26.7	97.3	6.4	24.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	42.7	106.4	19.1	91.2	30.7	87.9	41.4	134.1	45.5	136.1	40.4	131.1	30.0	111.8	22.4	82.4	17.3	60.7	31.0	126.7	25.7	78.0	18.5	40.9	30.5	103.1
1977	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	22.6	61.7	0	0	8.6	27.2	36.3	84.6	12.7	44.2	21.3	55.6	7.1	23.6	19.8	86.4	1.3	4.3	12.7	51.8	0	0	5.3	34.5	14.5	69.9
1979	16.9	41.4	14.0	29.7	12.5	37.6	34.7	97.0	34.3	75.9	28.7	76.8	18.8	42.9	16.3	69.3	1.5	1.8	20.5	50.8	6.8	18.5	6.4	14.2	31.1	73.7
1980	13.8	30.3	19.7	49.0	12.9	25.3	25.0	66.8	17.4	59.3	12.7	37.1	10.6	19.2	21.0	42.6	3.7	5.1	14.6	37.0	13.1	14.8	0.6	2.5	7.4	23.5
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	15.9	38.3	12.3	43.2	19.4	61.5	19.7	48.3	34.1	82.8	19.5	45.1	20.1	86.9	15.1	66.8	9.3	17.9	21.7	125.7	16.5	65.0	8.3	37.6	20.7	84.6

YEAR	Carlyle C-7		Estevan C-9		Hitchcock		Hume C-8		Oxbow C-10		Weyburn	
	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water	Snow	Water
1979	31.5	71.1	30.9	90.2	47.4	140.5	20.0	49.0	18.6	44.5	24.1	57.4
1980	23.1	61.6	11.0	22.3	27.9	82.2	21.3	41.8	17.3	38.3	16.0	33.6
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	33.3	86.0	28.0	91.4	25.3	72.8	19.7	46.4	10.5	33.0	32.8	108.8

Snow = cm of snow

water = mm of water

CHAPTER III

FORECASTING

Runoff forecasts issued by the Hydrology Branch are summarized in Table 3. All forecasts were based on recorded precipitation data up to the forecast date and a normal event to the end of the forecast period.

During the runoff season the Hydrology Branch updated streamflow forecasts daily as upstream flows materialized, thus enabling downstream interests to anticipate the oncoming flows. These forecasts were particularly useful in planning the operation of Boundary Reservoir.

Table 3

SOURIS RIVER BASIN

1982 SPRING RUNOFF FORECAST SUMMARY

Location	FORECASTED									RECORDED				
	MARCH 1			MARCH 15			APRIL 1							
	Volume	Peak	Stage	Volume	Peak	Stage	Volume	Peak	Stage	Volume	Instantanious Peak	Mean Daily Peak	Stage	Date
Boundary Reservoir Inflow	50	50		80	60		90	80		65	110	102		Apr. 15
Souris River at Weyburn	30	20	564.0	40	35	564.5	50	45	564.8	57	60	55	565.3	Apr. 18
Souris River Near Halbrite	50	30	550.8	80	50	551.8	90	80	552.7	78	88	85	552.7	Apr. 19
Souris River Near Estevan	90	60	536.2	180	90	537.0	210	140	537.5	133	93	84	537.1	Apr. 23
Souris River at Roche Percee	100	65	527.9	190	100	529.5	230	150	530.0	160	84	84		Apr. 25
Moose Mountain Creek Near Oxbow	40	40	520.2	50	50	520.4	70	80	520.7	34	116	100	521.0	Apr. 15
Souris River Near Oxbow	160	80	506.8	250	120	511.7	290	170	512.3	200	159	139	513.0	Apr. 15

Note: Volume = $m^3 x 10^6$ March to May
Peak = m^3/s
Staye = m

CHAPTER IV

FLOWS IN THE SOURIS RIVER BASIN

Hydrographs of the 1982 spring runoff event at the main hydrometric stations in the basin showing mean daily flows and/or stage are shown on Figures 6 to 11, inclusive.

A. LONG CREEK

Flows in Gibson Creek were established by April 10 and peaked rapidly on April 13 at a flow of 35 m^3/s. Flows then receded slowly (see Figure 6). The headwaters on Long Creek joined the Gibson Creek flows by April 14, contributing to the rise in flows on Long Creek from Radville to Maxim. The first peak at the hydrometric station "Long Creek near Noonan" occurred on April 15 at 120 m^3/s. Contributing to this peak was snowmelt just above Western Crossing and the Crosby N.D. area. Western Crossing peaked around 70 m^3/s while there was still a heavy snowcover in the area. Meanwhile at Neptune and above Maxim, water was being backed-up by roads but the channels and structures were open and flowing freely. Maxim held a steady crest for three days, April 17, 18 and 19, at just under 40 m^3/s. The second peak came into Western Crossing and Noonan on April 20 at 45 m^3/s and 55 m^3/s, respectively.

B. BOUNDARY RESERVOIR AND ESTEVAN AREA

Boundary Reservoir was very low (556.8 m) prior to April 15 when the first peak occurred at Noonan. On April 15 the Boundary Dam gates were partially opened to allow a large portion of water to pass. This was desirable in order to save storage capacity in Boundary Reservoir for a later time when the mainstem Souris River peak flow would reach the River Park area south of Estevan. Flows up to 80 m^3/s were released from Boundary Reservoir into the Souris during April 16 and 17. Boundary Reservoir came within 1.8 m of filling but then was drawn down again by 0.8 m. During April 16 and 17, some of the release flowed upstream on the Souris past Highway #18 as shown on Figure 9. The estimated quantity that flowed upstream is 2.6 $m^3 \times 10^6$ m^3, or 7 per cent of the total flow volume of Long Creek for April. Table 4 and Figure 12 show stages experienced in the area.

By April 20 the flow in the Souris River above Long Creek was over 30 m^3/s. Because of potential flooding problems in the River Park area, 3 gates on Boundary Reservoir were closed on the evening of April 20 and the remaining two gates on April 21, thus reducing flows from Long Creek while high flows on the mainstem Souris River passed through the River Park Area. Peak flows on the Souris River at #47 Highway reached almost 90 m^3/s and a peak stage of 536.98 m during the April 23 to 25 period as the peak on the Souris River passed.

Table 4
SOURIS RIVER BASIN
STAGE COMPARISONS
HIGHWAYS #18 AND #47

Point *	April, 17 Elev.	April, 20 Elev.	April, 21 Elev.	April, 22 Elev.	Description
1	536.49	537.21	537.50	537.63	Souris R. at Hwy #18 bridge
2	536.46	537.14			Souris R. at CPR bridge
3	536.52	537.13			Souris R. N. of ponding weir
4	536.79				Souris R. S. of ponding weir
5	536.41	536.93			Souris R. below Diversion Cut
6	536.40				Old Souris Channel above Diversion
7		536.93			Souris R. below Diverion
8	536.80	537.14			Old Souris Channel W. of ponding weir
9	536.55	537.06	537.22		Old Souris Channel
10	536.51	537.00		537.17	Old Souris Channel
11	536.28	536.82	536.90	536.98	Souris R. at Hwy #47 bridge
12	536.23	536.78		536.91	Souris R. below Hwy. #47
13	539.83				Top of dyke
14	539.70				Top of dyke
15	539.48				Top of dyke
16	539.31				Top of road
17	538.27				Top of road
Time	14:00-18:00	12:00-14:00			
Flow at #18			70 m^3/s	90 m^3/s	
Flow on Long Cr.	65 to 70 m^3/s	51 m^3/s	0 m^3/s	0 m^3/s	
Flow at #47	61 m^3/s	77 m^3/s	75 m^3/s	85 m^3/s	
Comments	Flow at Hwy #18 in process of reversing direction of flow	weir near diversion is submerged			

* Points are shown on Figure 12

The gates at Boundary Reservoir were opened late on April 24 to release 13 m^3/s because the reservoir had filled. From this date on, the flows on the Souris River receded as shown on Figure 10. If Boundary Reservoir had not been operated in this way the peak flow at Highway #47 would have been about 110 m^3/s with a peak stage of 537.4 m.

C. UPPER SOURIS

The Souris River channel was in generally good condition to receive flows along its length when flows started during the April 15 to 16 period. Figure 8 shows that Yellow Grass ditch started flowing April 16 but peaked much later, from April 21 to 25 at just below 30 m^3/s. The flows at the McTaggart hydrometric station, however, peaked at just over 30 m^3/s on April 17 and remained approximately at that level for over a week due to outflow from Yellow Grass marsh. The Souris River above Weyburn peaked on April 18 around 50 m^3/s and then receded gradually. There were above normal flows in the immediate Weyburn area from tributaries to the Souris but because the channels, including the mainstem, were clear and there was little ice to cause problems, flows passed without exceeding the banks. Nickle Lake (Weyburn Reservoir) filled by April 18th. Farther downstream on the Souris at Halbrite, flows peaked at just over 85 m^3/s on April 19 (see Figure 9).

Jewel and Roughbark Creek Basins, major tributaries to the Souris downstream of Weyburn Reservoir, peaked on April 18.

Jewel Creek peaked at about 35 m^3/s. The flows in the Souris River at Dead Lake peaked on April 20. This all lead to the Souris peaking above Long Creek (Hwy #18) on April 22 and 23 at just under 90 m^3/s. The flow on the Souris at Highway No. 47 did not exceed this same peak because of the operations on Boundary Dam which restricted Long Creek flows during this period.

D. LOWER SOURIS

Short Creek flows from the south peaked early on April 14 at approximately 40 m^3/s. The Souris River at Roche Percee gradually increased from this flow to a peak of 85 m^3/s on April 25.

Farther downstream, Moose Mountain Creek stage rose on April 12 because of ice and, subsequently again on April 15 with flows of 116 m^3/s. The first flows in the Souris River carried in ice from Moose Mountain Creek and from the Souris to cause ice jamming at the Beaver Park subdivision near Oxbow on April 15 and 16. The stage rose dramatically by over a metre as ice jammed above the Oxbow weir. Dynamite was used to help dislodge the ice.

The Souris River near Glen Ewen received a surge of water on April 16 from Moose Mountain Creek and from local sources to peak at 159 m^3/s. Flows then tappered off to reflect the flows coming from Souris mainstream which persisted for a period of about two weeks at 80 m^3/sec.

CHAPTER V

FLOOD PROBLEMS AND ACTIVITIES

By mid-April the Souris River Basin still had a heavy snowpack and there was a growing concern about flooding because of the rate of melt that could occur at this time of year.

A. WEYBURN

Flows through Weyburn provided an opportunity for co-operation between many interested government departments and agencies to co-ordinate efforts in collecting flow data. Saskatchewan Environment, Saskatchewan Agriculture, Environment Canada, Saskatchewan Department of Highways, E.M.O. and the City of Weyburn all took part.

Sandbagging was done in Weyburn in the Highway No. 39 area in anticipation of flows exceeding the banks. Peaks came on April 18 but, with little ice, flows passed at bank-full capacity without incident.

B. ESTEVAN

Saskatchewan Environment, Highway's personnel and E.M.O. set up field offices at Estevan from April 16 to 23 to monitor water levels and take necessary protective action against flooding. Profiles were surveyed on the dykes around River Park near

Estevan. Sandbags were used to top off dykes in low spots at River Park. Plastic sheets and sandbags were placed over an area on the west side of the River Park dyke. A natural gas line had been bored through the dyke in 1981 to service the B & B Trailer Park; a branch from the gas line servicing the Water Treatment Plant. There was concern that with large flows, the newly disturbed area would erode and result in piping along the gas line.

William Shipman is the owner of the River Park B & B Trailer Park. He rents out space for house trailers, operates a dance hall and cafe and resides there in a house on a full basement. The trailers are mostly of the more modern type, and are not easily moved.

On April 20 there was trouble with Mr. Shipman's sewage system. He called for help when he found that his system was backing up from the river. The system is a two-compartment septic tank (pit) located adjacent to Mr. Shipman's residence with a drain from the house into a cindercrete block lined pit and an underground discharge pipeline to the Souris River. One compartment receives raw sewage and acts as a settling tank from which overflow occurs into the second compartment. The second compartment in turn has a drain near the bottom which leads out under the dyke through a perforated pipe. This pipe apparently drains into a barrel which in turn drains into the river. Apparently there are two or more similar drains under the dyke, one for the dance hall, another for the cafe and possibly others for the trailers.

Mr. J. Pawson has a market garden in the valley S.W. of River Park. He was concerned about flooding in his root cellar. Some commodities were moved out and the cellar was partly sandbagged. A rail on the railway track was repaired in order that Mr. Pawson could move produce out on a hand car if the need arose. The R.M. of Estevan also slightly improved the access road from the west so that motor vehicle travel would be maintained longer for Mr. Pawson and the water treatment plant.

At an early date, the coal hall road was breached in the usual spot to allow some water to pass through an old meander.

The water treatment plant road was breached in two places; the first cut was made 100 metres north of the water treatment plant and the second at the old PFRA Souris River Diversion. The second cut passed a large portion of the water from upper Souris but water levels didn't get high enough to pass through the first cut.

Dennis Ball lives within the same meander of the river and dyke loop that encompasses the water treatment plant. Initially, there was a cross dyke to separate the two but it was recently removed. Now if one establishment floods so will the other.

Immediately east of Highway No. 47, there are a number of dwellings, one of note being a trailer owned by H. Magrath. Water reached to the top of his steps but it wasn't reported to have

entered his trailer. Some of the Regional Park improvements in this same general area were surrounded by water.

C. ROCHE PERCEE

At Roche Percee the Souris River channel was quite capable of handling the flows during the 1982 spring runoff. Water levels did not exceed the river banks. Some water backed up within the dyked area due to an incomplete seal on a C.M.P. flapgate but a minimum pumping effort over the dykes into the Souris River prevented any flood damage. Profiles were surveyed along the south bank of the Souris River at Roche Percee.

D. OXBOW

Beaver Park near Oxbow experienced the usual ice jamming problems in the Souris valley area. Water and ice came in from Moose Mountain Creek, lifting the ice on the Souris River on April 15 and 16; an ice jam at the bridge and weir raised the stage over a metre. Dynamite was used to attempt to break up the ice jam.

E. RADVILLE

Although no flood problems arose in Radville, this community was identified in the Canada-Saskatchewan Flood Damage Reduction Program. Spring runoff in 1982 permitted the monitoring of discharge and stage throughout the area in question where water levels approached near bank capacities. As a consequence, a number of sets of profiles were obtained through Radville which will

assist in describing the hydraulics of this system for the flood hazard mapping program.

FIGURES

Souris River Basin

HYDROMETRIC STATIONS

REGINA

CANADA

U.S.A.

1-GIBSON CREEK NEAR RADVILLE
2-LONG CREEK NEAR MAXIM
3-LONG CREEK NEAR WESTERN CROSSING
4-LONG CREEK NEAR NOONAN
5-BOUNDARY RESERVOIR
6-LONG CREEK NEAR ESTEVAN
7-SOURIS RIVER NEAR LEWVAN
8-SOURIS RIVER NEAR BECHARD
9-YELLOW GRASS DITCH NEAR YELLOWGRASS
10-SOURIS RIVER NEAR McTAGGART
11-SOURIS RIVER ABOVE WEYBURN
12-WEYBURN RESERVOIR
13-SOURIS RIVER AT HALBRITE
14-JEWEL CREEK NEAR GOODWATER
15-SOURIS RIVER AT DEAD LAKE
16-SOURIS RIVER AT # 18 HIGHWAY
17-SOURIS RIVER AT # 47 HIGHWAY
18-SHORT CREEK NEAR ROCHE PERCEE
19-SOURIS RIVER NEAR ROCHE PERCEE
20-MOOSE MOUNTAIN CREEK NEAR OXBOW
21-SOURIS RIVER AT OXBOW
22-SOURIS RIVER NEAR GLEN EWEN
23-MOOSE MOUNTAIN LAKE NEAR CORNING
24-MOOSE MOUNTAIN CREEK BELOW MOOSE MOUNTAIN LAKE

LOCATION PLAN

Saskatchewan Environment

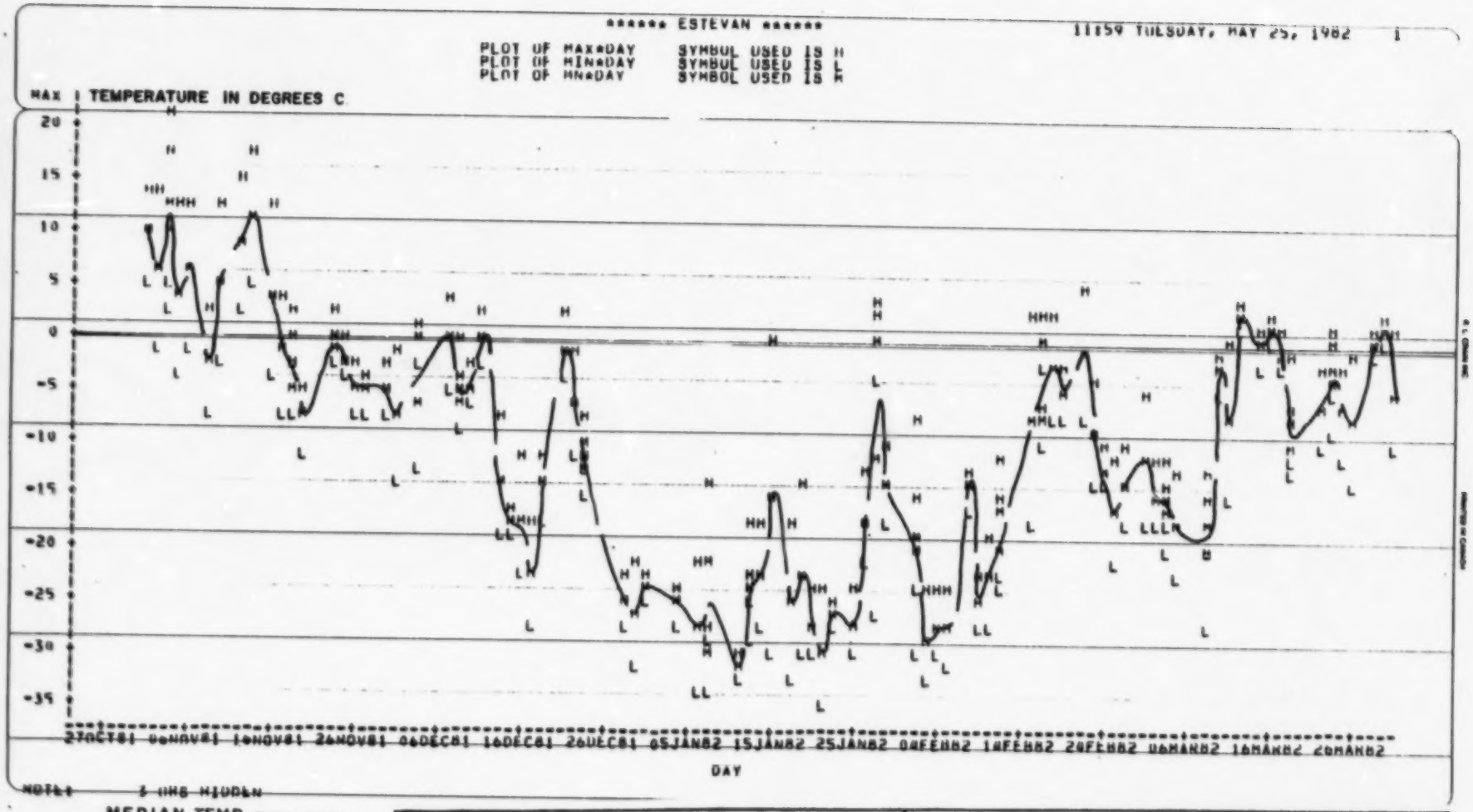
Hydrology Branch

SOURIS RIVER BASIN 1982 SPRING RUNOFF

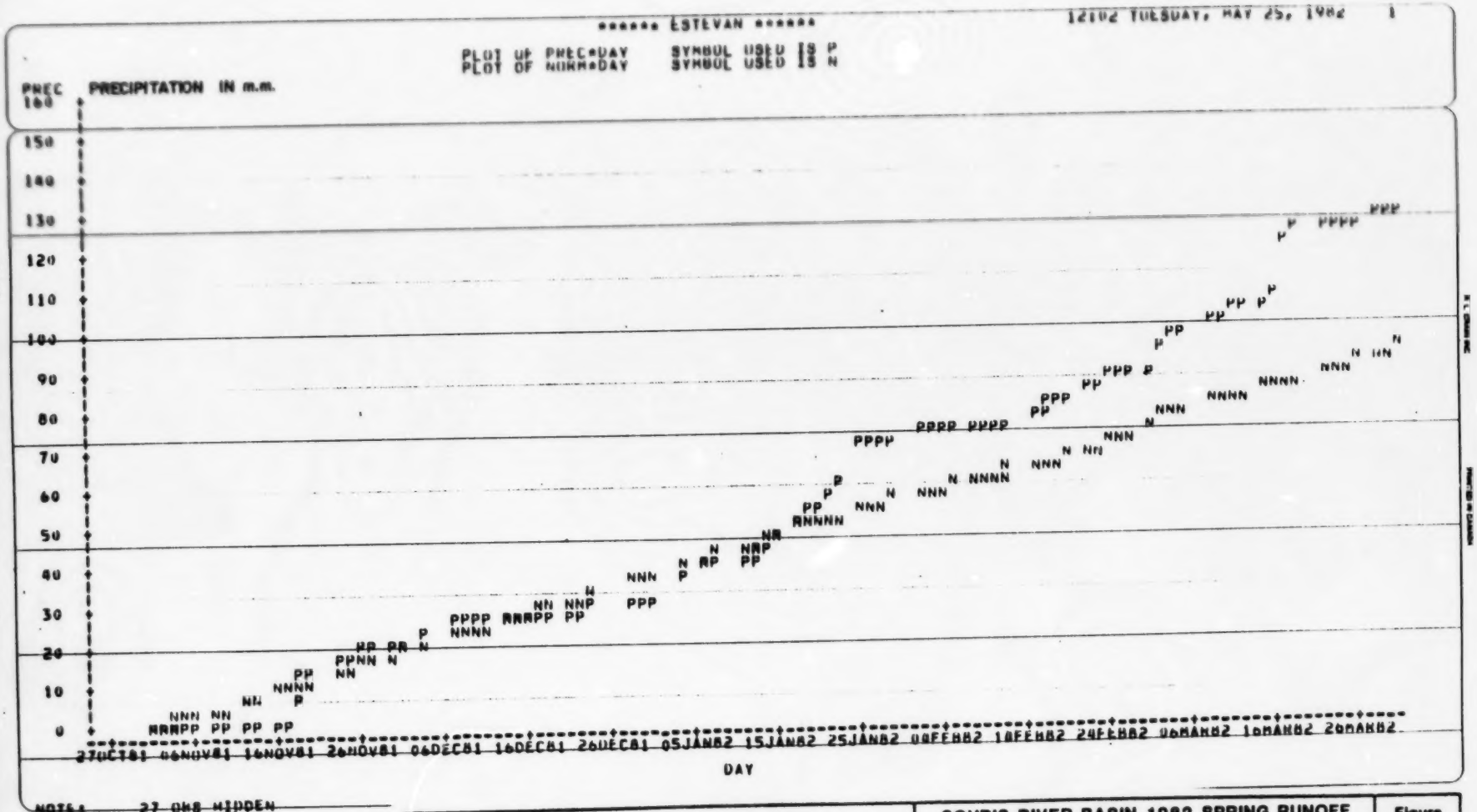
SOURIS RIVER BASIN

HYDROMETRIC STATIONS

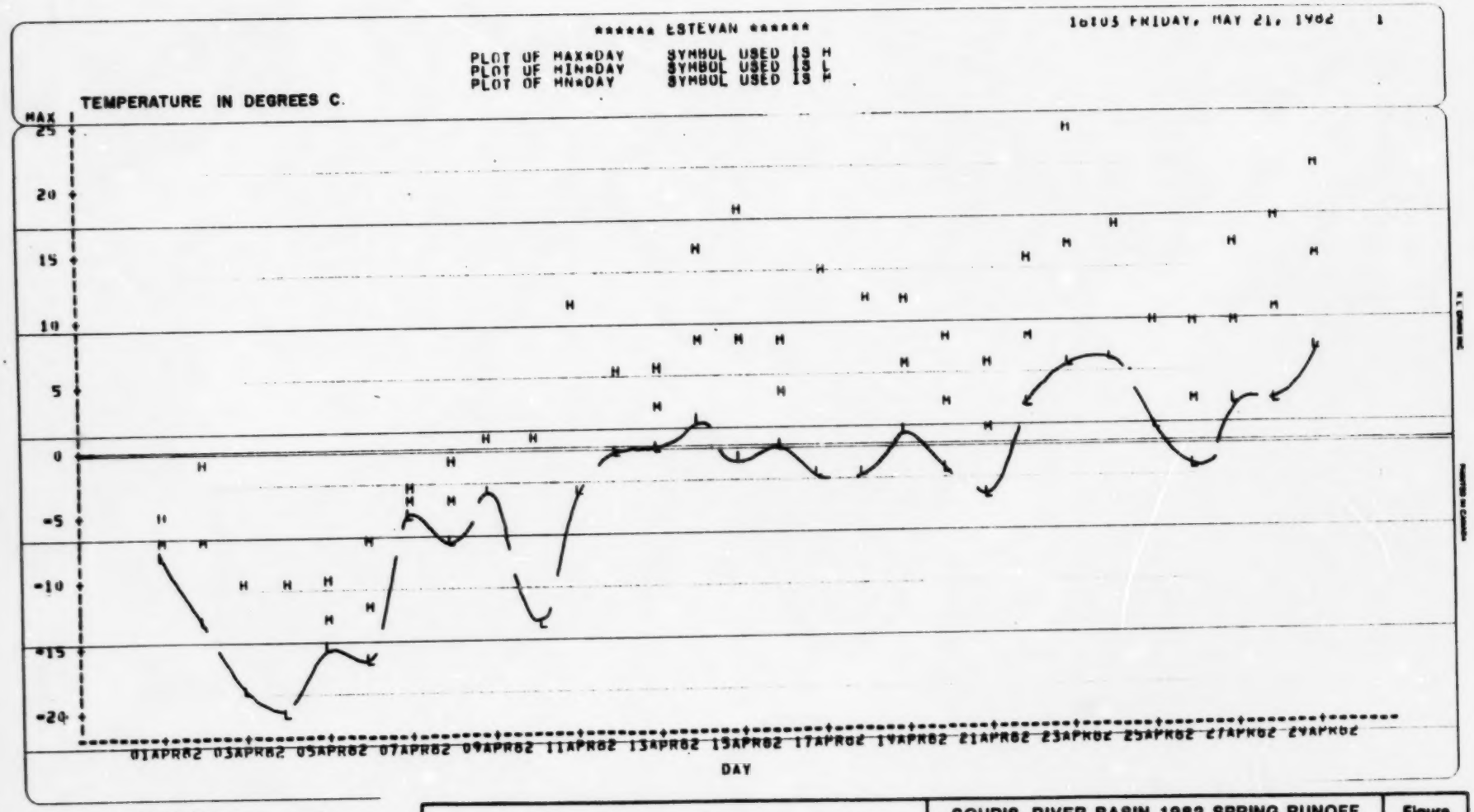
Drn C.B.B.	Date DEC./83	Figure 1
Ck'd	Plan No.	



Saskatchewan Environment		SOURIS RIVER BASIN 1982 SPRING RUNOFF TEMPERATURERS AT ESTEVAN NOVEMBER 1981 TO MARCH 1982	Figure 2
Drn	Date		
Ck'd	Plan No.		

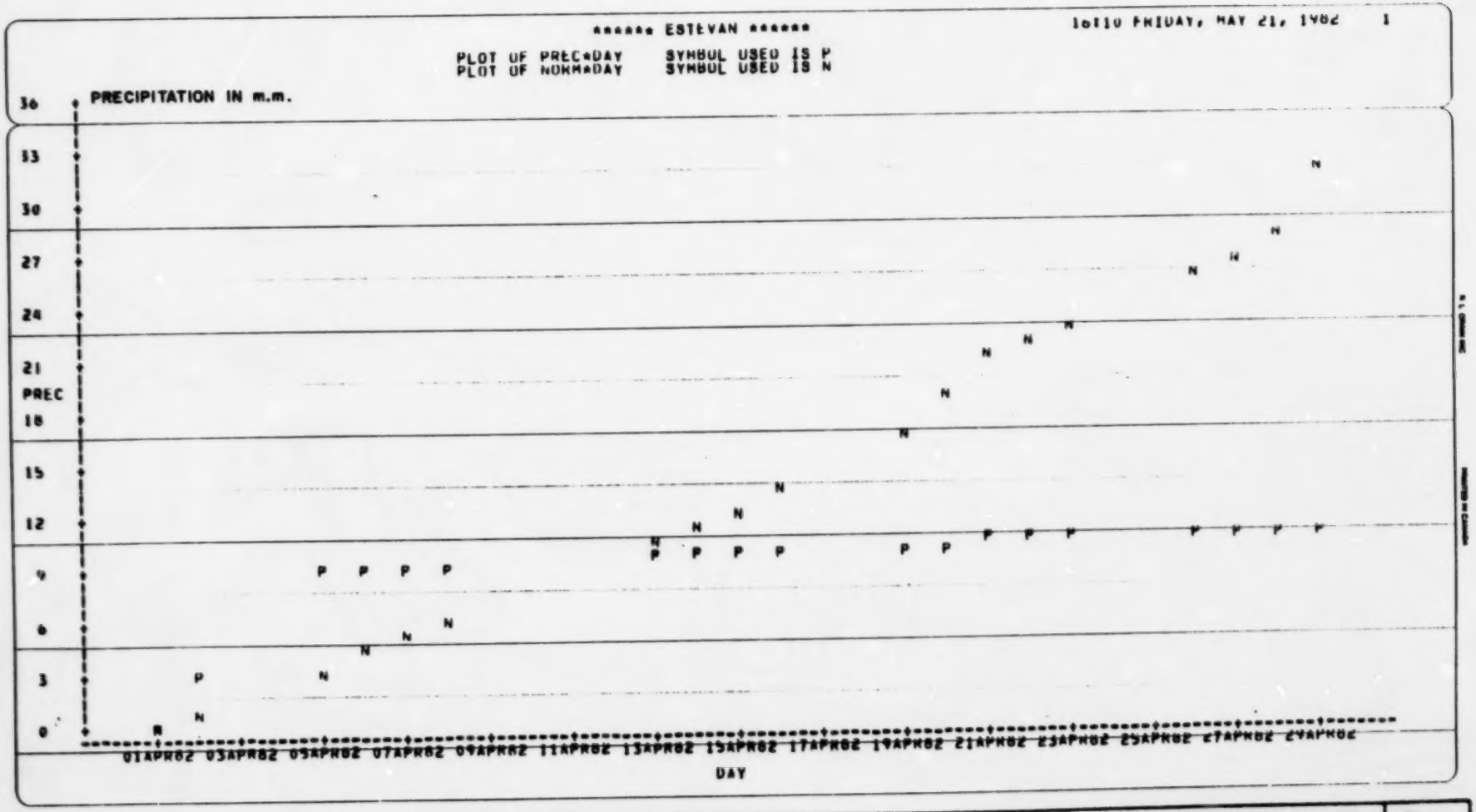


Saskatchewan Environment		SOURIS RIVER BASIN 1982 SPRING RUNOFF PRECIPITATION AT ESTEVAN NOVEMBER 1981 TO MARCH 1982	Figure
Drn	Date		3
Ck'd	Plan No.		



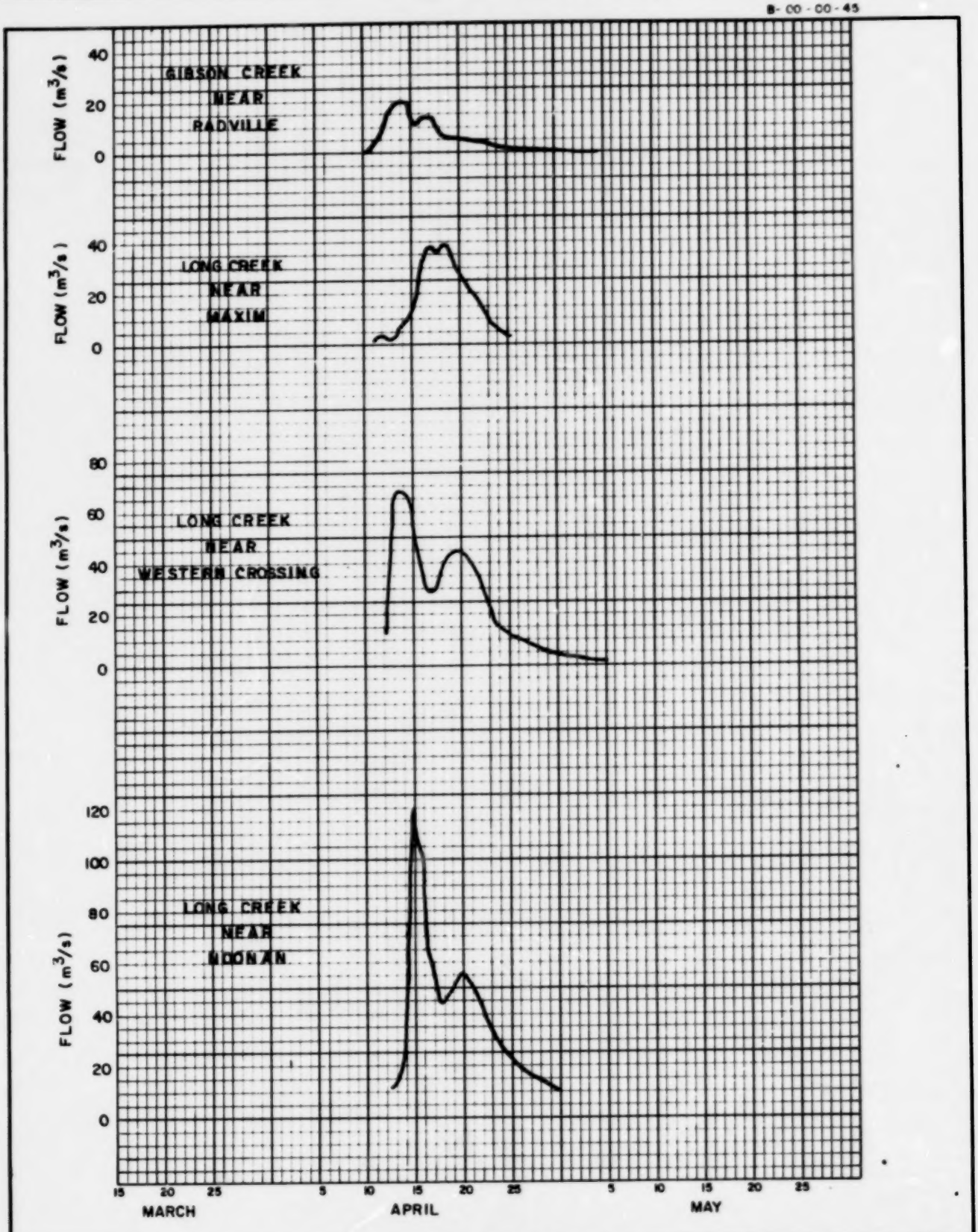
LOW TEMP — —

Saskatchewan Environment		SOURIS RIVER BASIN 1982 SPRING RUNOFF TEMPERATURES AT ESTEVAN APRIL 1982	Figure 4
Drn	Date		
Ck'd	Plan No.		



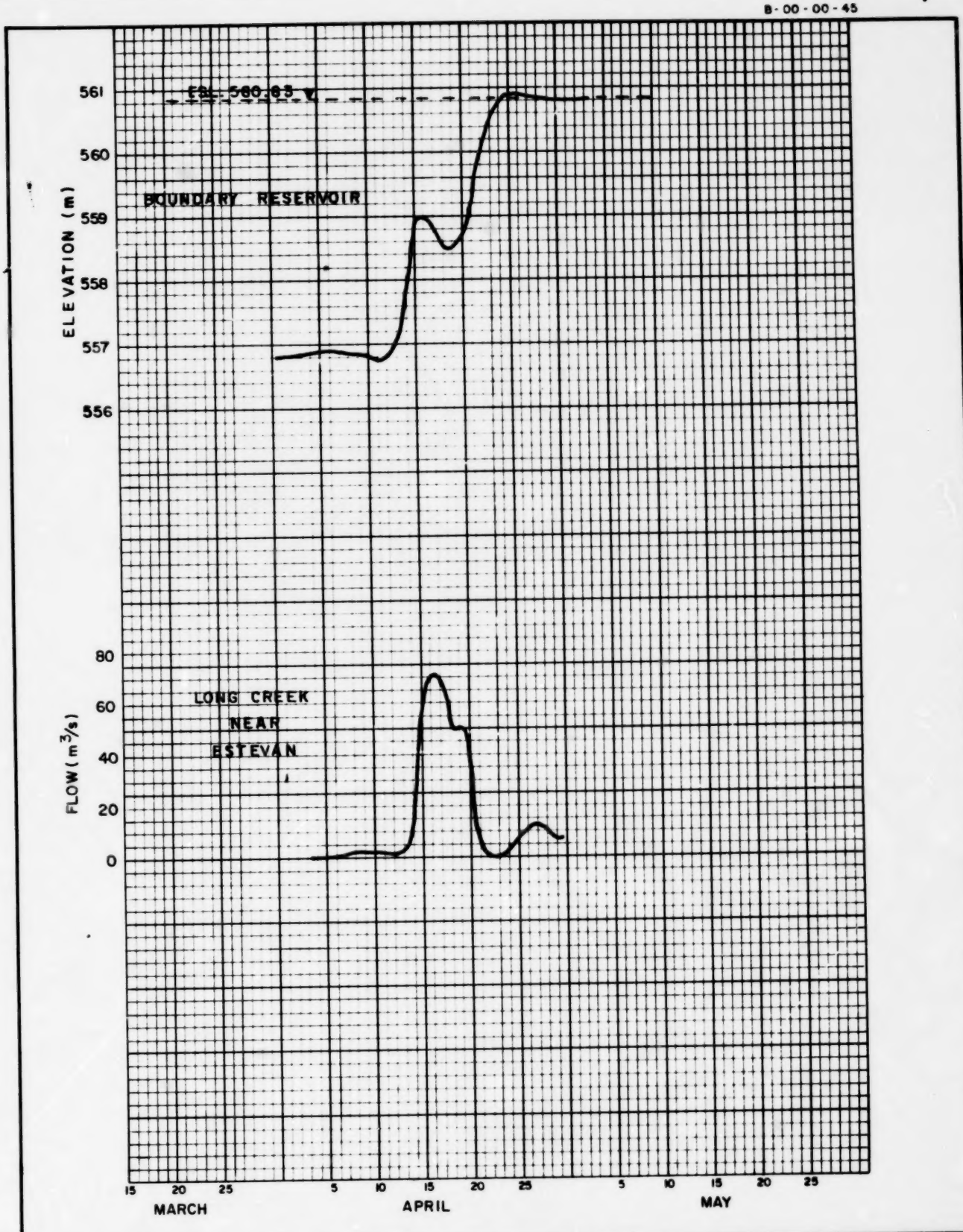
Saskatchewan Environment		SOURIS RIVER BASIN 1982 SPRING RUNOFF PRECIPITATION AT ESTEVAN APRIL 1982	Figure 5
Drn	Date		
Ck'd	Plan No.		

B-00-00-45



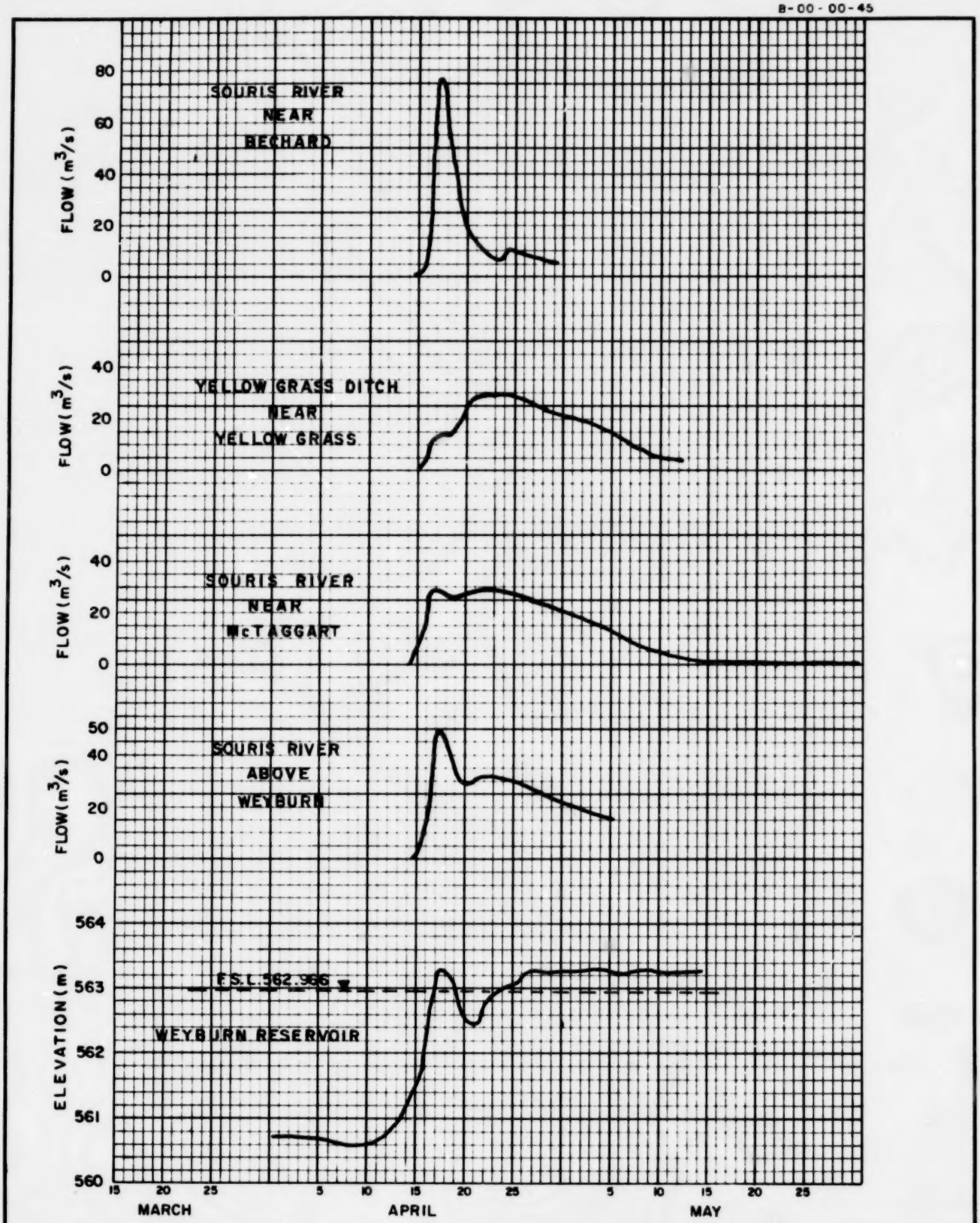
Saskatchewan Environment Hydrology Branch		SOURIS RIVER BASIN 1982 SPRING RUNOFF 1982 SPRING RUNOFF HYDROGRAPHS UPPER LONG CREEK SYSTEM	Figure 6
Drn. J.W.W.	Date AUG./82		
Ck'd.	Plan No.		

B-00-00-45



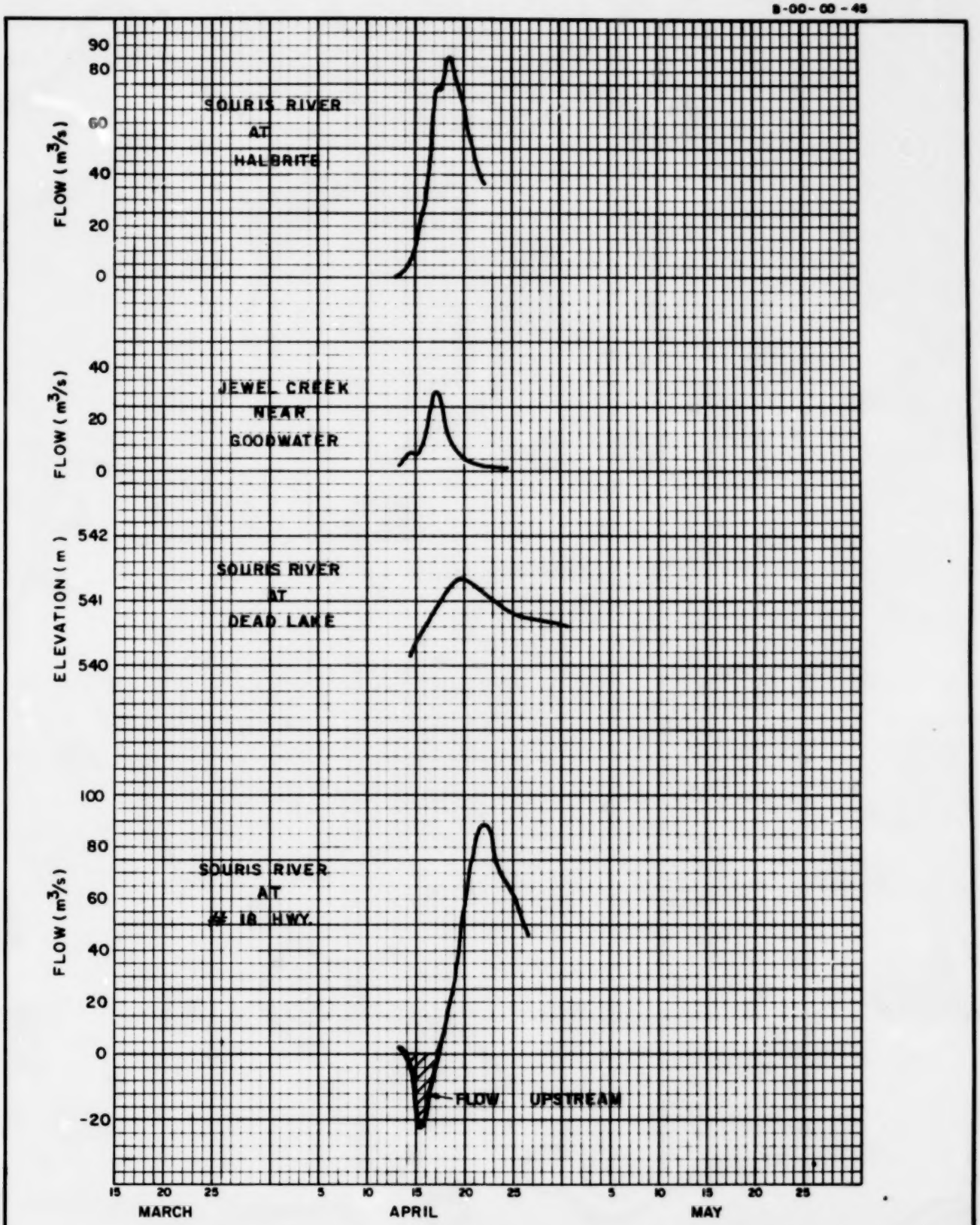
Saskatchewan Environment Hydrology Branch		SOURIS RIVER BASIN 1982 SPRING RUNOFF 1982 SPRING RUNOFF HYDROGRAPHS LOWER LONG CREEK SYSTEM	Figure 7
Drn. J. W. W.	Date AUG. / 82		
Ck'd.	Plan No.		

B-00-00-45



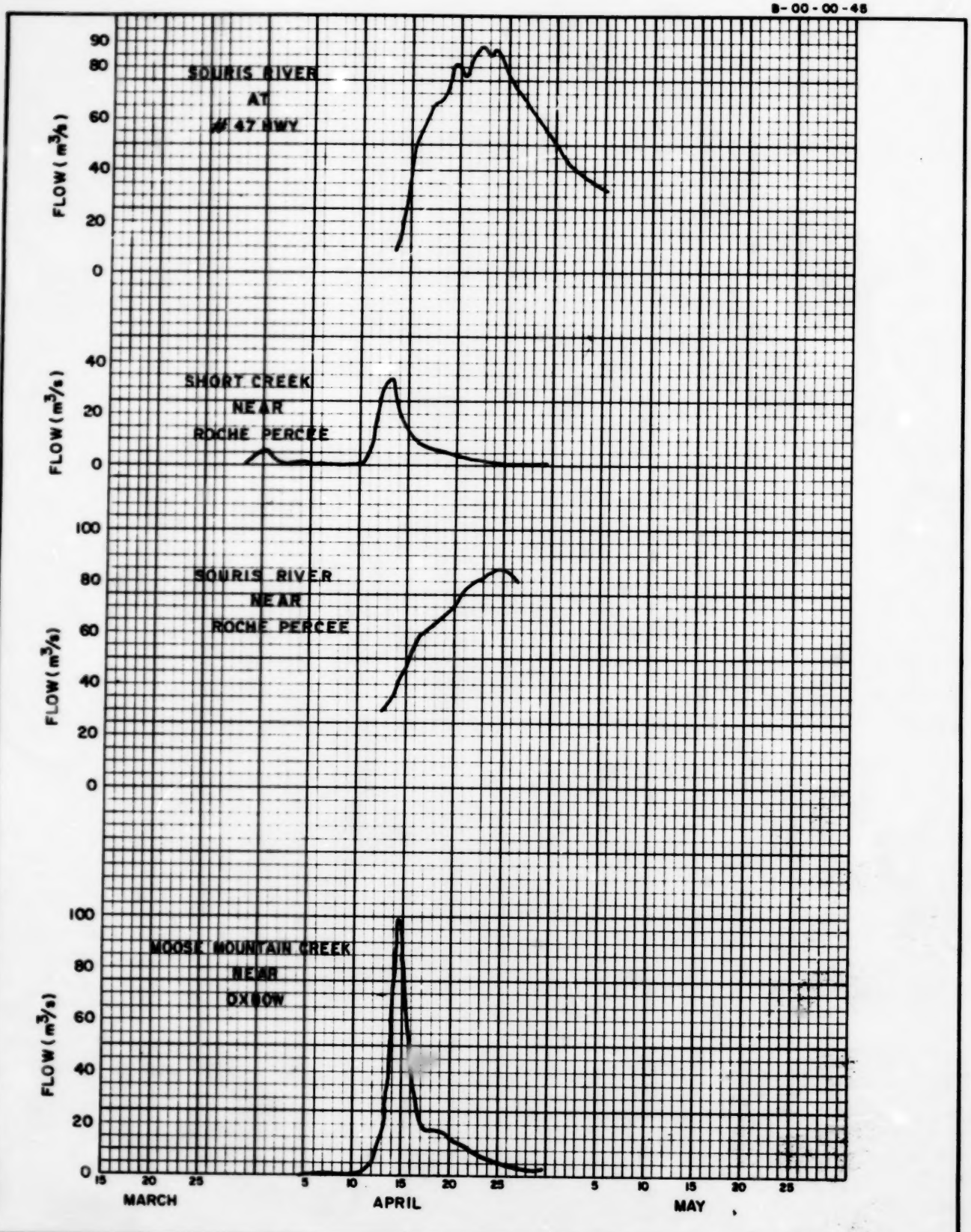
Saskatchewan Environment Hydrology Branch		SOURIS RIVER BASIN 1982 SPRING RUNOFF 1982 SPRING RUNOFF HYDROGRAPHS SOURIS RIVER UPSTREAM OF WEYBURN	Figure 8
Drn. J.W.W.	Date AUG. / 82		
Ck'd.	Plan No.		

B-00-00-45

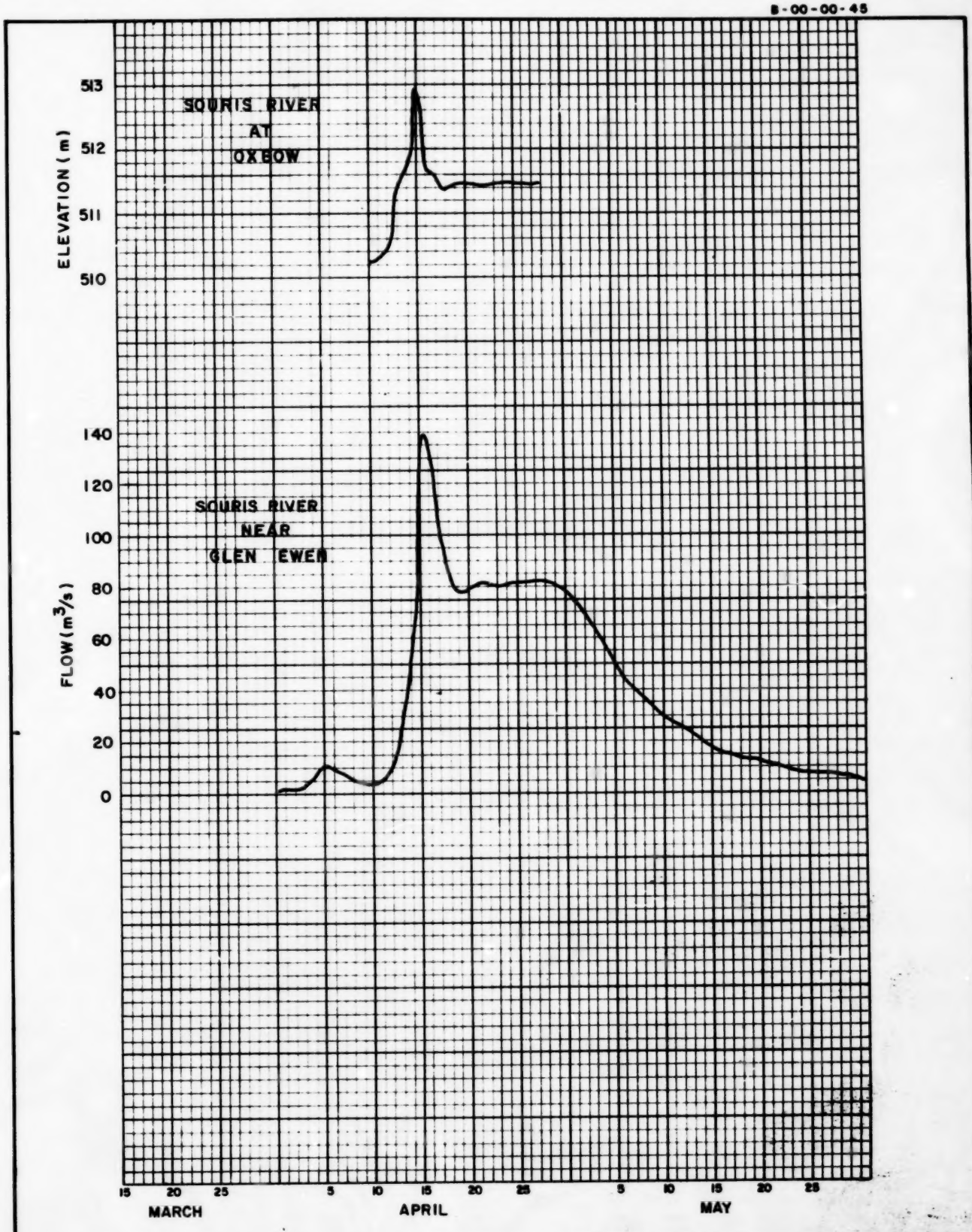


Saskatchewan Environment Hydrology Branch		SOURIS RIVER BASIN 1982 SPRING RUNOFF 1982 SPRING RUNOFF HYDROGRAPHS SOURIS RIVER BETWEEN WEYBURN AND ESTEVAN	Figure 9
Drn. J. W. W.	Date AUG./82		
Ck'd.	Plan No.		

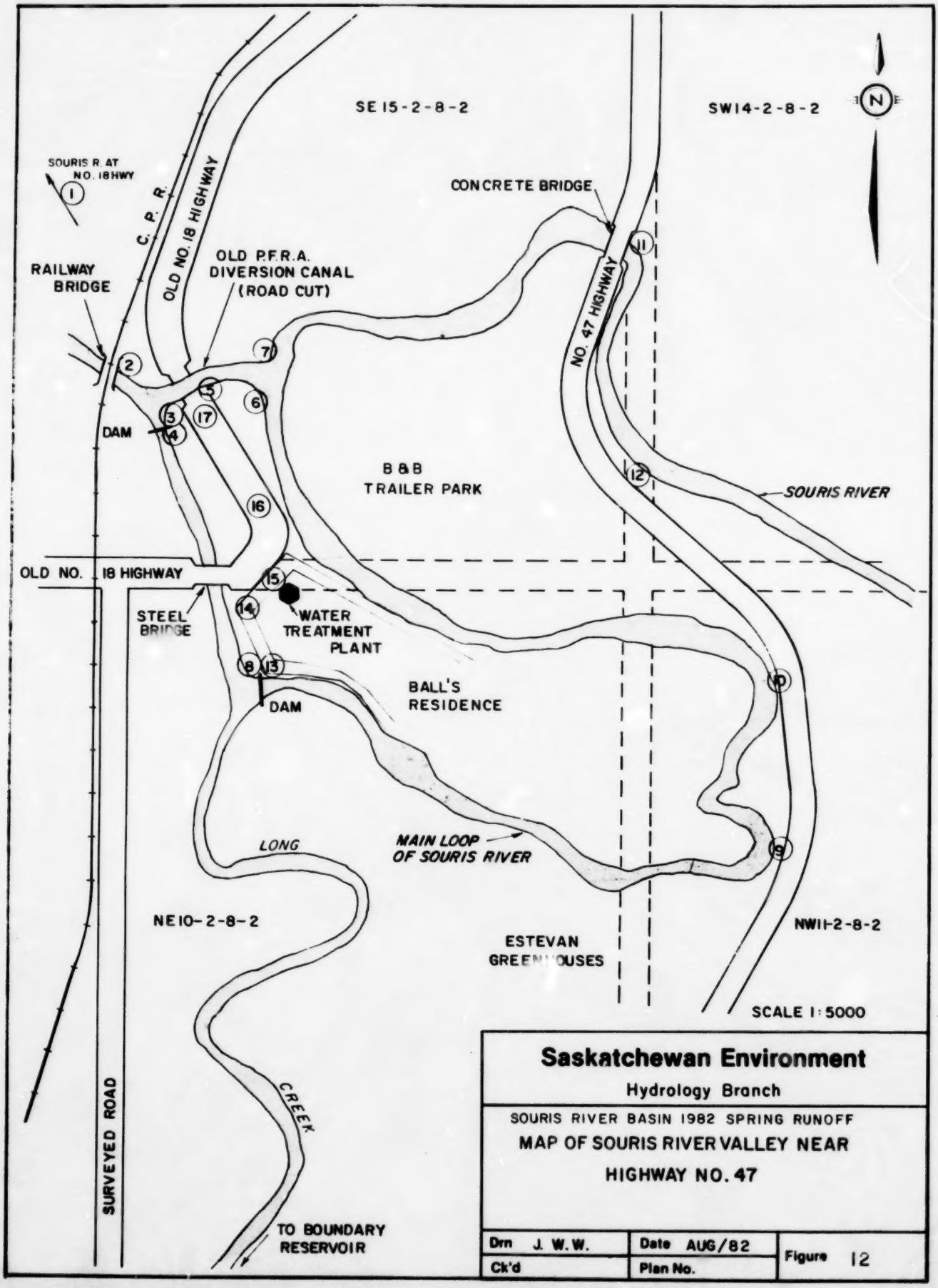
B-00-00-45



Saskatchewan Environment Hydrology Branch		SOURIS RIVER BASIN 1982 SPRING RUNOFF 1982 SPRING RUNOFF HYDROGRAPHS SOURIS RIVER ESTEVAN TO MOOSE MOUNTAIN CREEK	Figure 10
Drn. J. W. W.	Date AUG. /82		
Ckd.	Plan No.		



Saskatchewan Environment Hydrology Branch		SOURIS RIVER BASIN 1982 SPRING RUNOFF 1982 SPRING RUNOFF HYDROGRAPHS SOURIS RIVER MOOSE MOUNTAIN CREEK TO GLEN EWEN	Figure 11
Drn. J.W.W.	Date AUG. / 82		
Ck'd.	Plan No.		



Saskatchewan Environment

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SOURIS RIVER BASIN 1982 SPRING RUNOFF

MAP OF SOURIS RIVER VALLEY NEAR HIGHWAY NO. 47

Drn J. W. W.	Date AUG/82	Figure 12
Ck'd	Plan No.	

POOR

QUALITY

ORIGINAL